

What is claimed is:

1. A method for pre-cleaning apertures on a substrate, the method comprising:
  - disposing the substrate on a substrate support member in a process chamber;
  - cooling the substrate at least to a temperature of 100 degrees Celsius; and
  - exposing the substrate to a pre-clean process.
2. The method of claim 1, wherein the step of disposing the substrate on the substrate support member further comprises:
  - electrostatically chucking the substrate to the substrate support member.
3. The method of claim 1, wherein the step of cooling the substrate further comprises:
  - flowing a gas through the substrate support member to an area between the substrate support member and the substrate.
4. The method of claim 1, wherein the step of cooling the substrate further comprises:
  - transferring heat from the substrate through a thermoelectric device.
5. The method of claim 1, wherein the step of cooling the substrate further comprises:
  - transferring heat from the substrate through the substrate support member to a heat transfer fluid.
6. The method of claim 1, wherein the step of cooling the substrate further comprises:
  - cooling the substrate to between about -40 to about 75 degrees Celsius.

7. The method of claim 1, wherein the pre-clean process comprises:  
forming a plasma from a gas comprising argon, nitrogen or helium;  
and  
etching native copper oxide from the at least partially exposed layer.

8. The method of claim 7, wherein the pre-clean process further  
comprises:  
inductively coupling about 1 to about 1000 Watts to the plasma; and  
biasing a substrate support with less than about 300 Watts.

9. The method of claim 7, wherein the pre-clean process further  
comprises:  
flowing a reactive gas into the chamber to reduce native oxides or react  
and remove photoresist residue and contaminants.

10. A method for pre-cleaning apertures on a substrate, the method  
comprising:  
disposing the substrate on a substrate support member in a process  
chamber;  
electrostatically chucking the substrate to the substrate support  
member;  
cooling the substrate to less than about 100 degrees Celsius; and  
exposing the substrate a pre-clean process comprising a plasma  
formed from a gas comprising argon.

11. The method of claim 10, wherein the pre-clean process further  
comprises:  
inductively coupling about 1 to about 1000 Watts to the plasma;  
biasing a substrate support with less than about 300 Watts; and  
regulating the chamber pressure between about 0.5 to about 100  
mTorr.

12. A method for pre-cleaning apertures on a substrate, the method comprising:

cooling the substrate to less than about 100 degrees Celsius;

transferring the cooled substrate to a substrate support member disposed in a process chamber; and

exposing the substrate to a pre-clean process.

13. The method of claim 12, wherein the step of cooling the substrate further comprises:

cooling the substrate in a degas chamber.

14. The method of claim 12, wherein the step of cooling the substrate further comprises:

cooling the substrate in a cool-down chamber.

15. The method of claim 12, wherein the pre-clean process comprises:

etching native oxides disposed on the substrate while cooling the substrate to a temperature of between about -40 and about 75 degrees Celsius.

16. The method of claim 12, wherein the pre-clean process comprises: forming a plasma from a gas comprising argon, nitrogen or helium.

17. The method of claim 12, wherein the pre-clean process further comprises:

flowing a reactive gas into the chamber to reduce native oxides or react and remove photoresist residue and contaminants.

18. A method for pre-cleaning apertures on a substrate, the method comprising:

disposing the substrate on a substrate support member in a process chamber;

exposing an at least partially exposed copper layer on the substrate to

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a pre-clean process while maintaining a substrate temperature of less than about 100 degrees Celsius; and  
depositing a bulk layer of copper on the at least partially exposed layer.

19. A method for pre-cleaning apertures on a substrate, the method comprising:

disposing the substrate on a substrate support member in a process chamber;  
cooling the substrate at least to a temperature of 100 degrees Celsius;  
exposing an at least partially exposed copper layer to a pre-clean process; and  
depositing a barrier layer on the at least partially exposed layer.

20. The method of claim 19, wherein the step of depositing the barrier layer further comprises:

depositing a layer of silicon carbide, titanium nitride, tungsten nitride or tantalum nitride.

21. The method of claim 19, wherein the step of depositing the barrier layer further comprises:

depositing a layer of silicon carbide, titanium nitride, tungsten nitride or tantalum nitride.

22. A method for pre-cleaning apertures on a substrate, the method comprising:

cooling the substrate at least to a temperature of 100 degrees Celsius in a first chamber;  
transferring the substrate to a second chamber; and  
pre-cleaning an at least partially exposed layer in the second chamber while maintaining a substrate temperature of 100 degrees Celsius.

23. The method of claim 22, wherein the step of pre-cleaning further comprises:

providing backside gas between the substrate and a substrate support member.

24. The method of claim 23, wherein the step of pre-cleaning further comprises:

electrostatically chucking the substrate and the substrate support member.

25. The method of claim 22 further comprising:

transferring the substrate to a third processing chamber; and  
depositing a barrier layer on the at least partially exposed layer.

26. The method of claim 24, wherein the step of depositing the barrier layer further comprises:

depositing a layer of silicon carbide, titanium nitride, tungsten nitride or tantalum nitride.

27. A method for pre-cleaning apertures on a substrate having vias containing at least partially exposed copper features, the method comprising:

disposing the substrate on a substrate support member within a process chamber maintained at a chamber pressure of between about .5 to about 100 mtorr;

cooling the substrate to at least a temperature of between about -40 to about 100 degrees Celsius by maintaining a gas between a surface of the substrate support and a facing surface of the substrate to transfer heat from the substrate to the support member; and

exposing the at least partially exposed copper features to a pre-clean process comprising a plasma formed from a gas comprising a non-reactive gas.

28. The method of claim 27, wherein the substrate is cooled to a temperature of between about -40 to about 75 degrees Celsius.

29. The method of claim 27, wherein the plasma etches the copper without causing copper agglomerations on via surfaces.

30. The method of claim 27, wherein the pre-clean process gas further includes a reactive gas.

31. The method of claim 27 further comprising:  
depositing a barrier layer on the at least partially exposed and pre-cleaned copper features.

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